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Hasz et al.

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[54] **SEALED ELECTRICAL CONNECTOR WITH JACK SCREW**

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[51] **Int. Cl.**^{6} **H01R 13/627**

[52] **U.S. Cl.** **439/364**

[58] **Field of Search** 439/362–364, 439/595, 587, 589

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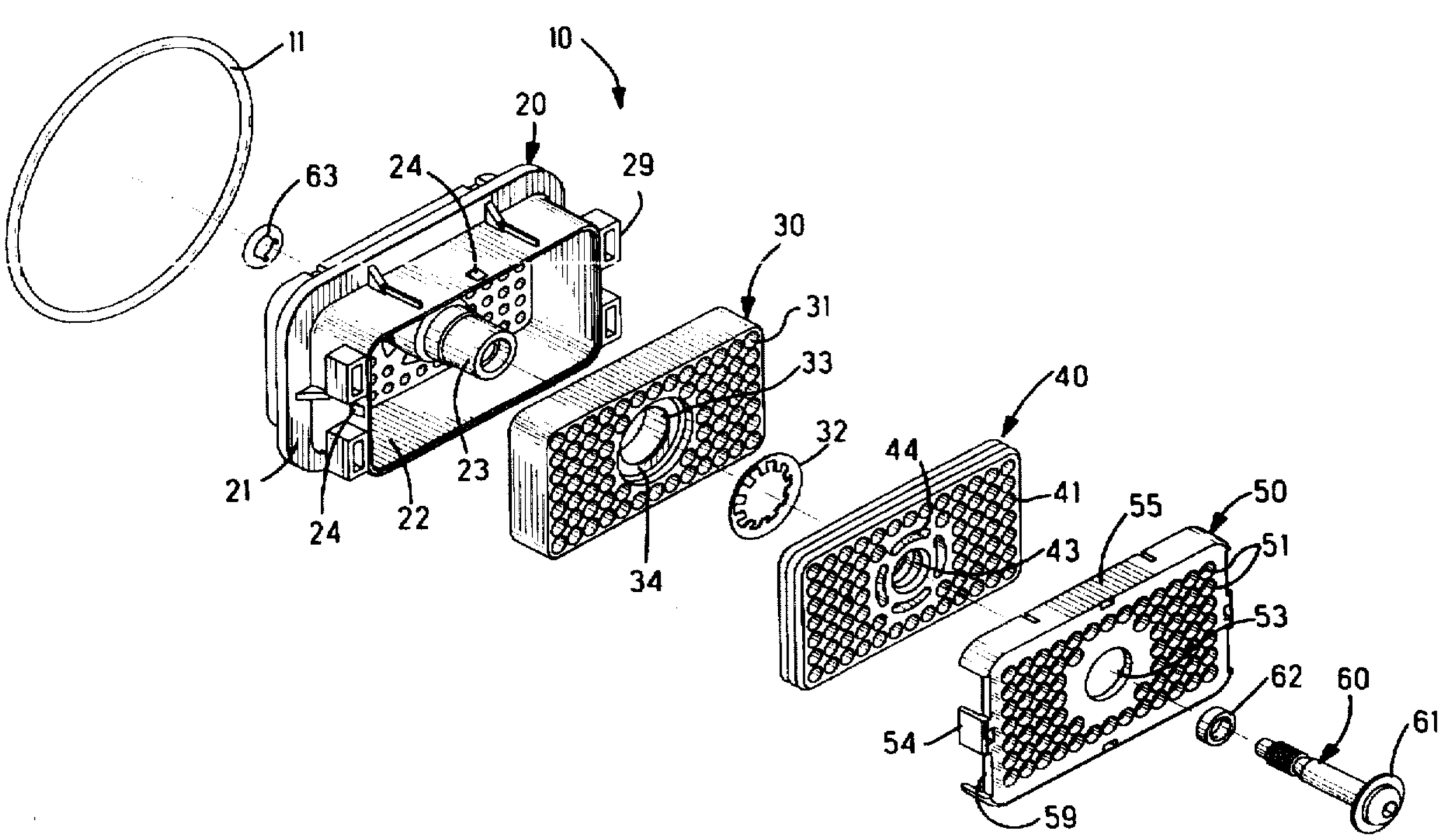
Attorney, Agent, or Firm—Bradley N. Ditty

[57] **ABSTRACT**

A mated assembly (**100**) includes a sealed connector subassembly (**10**), a cap housing (**20**), a contact retention insert (**30**), a wire seal (**40**), a seal cover (**50**), a jack screw (**60**), and a header housing (**70**). Jack screw (**60**) is used to matably join the subassembly (**10**) with the header (**70**). Subassembly (**10**) comprises a cap housing (**20**) which includes a cavity (**23**) wherein the contact retention insert (**30**) is disposed along with a blanket type seal (**40**) for receiving electrical contacts that will electrically mate with respective pins of contact array (**72**). The contact retention insert (**30**) is advantageously connected to the cap housing (**20**) by way of insert retaining clip (**32**), and the bolt (**60**) is free to rotate but is axially trapped within cap housing (**20**) between washer (**61**) and bolt retaining clip (**63**).

20 Claims, 6 Drawing Sheets



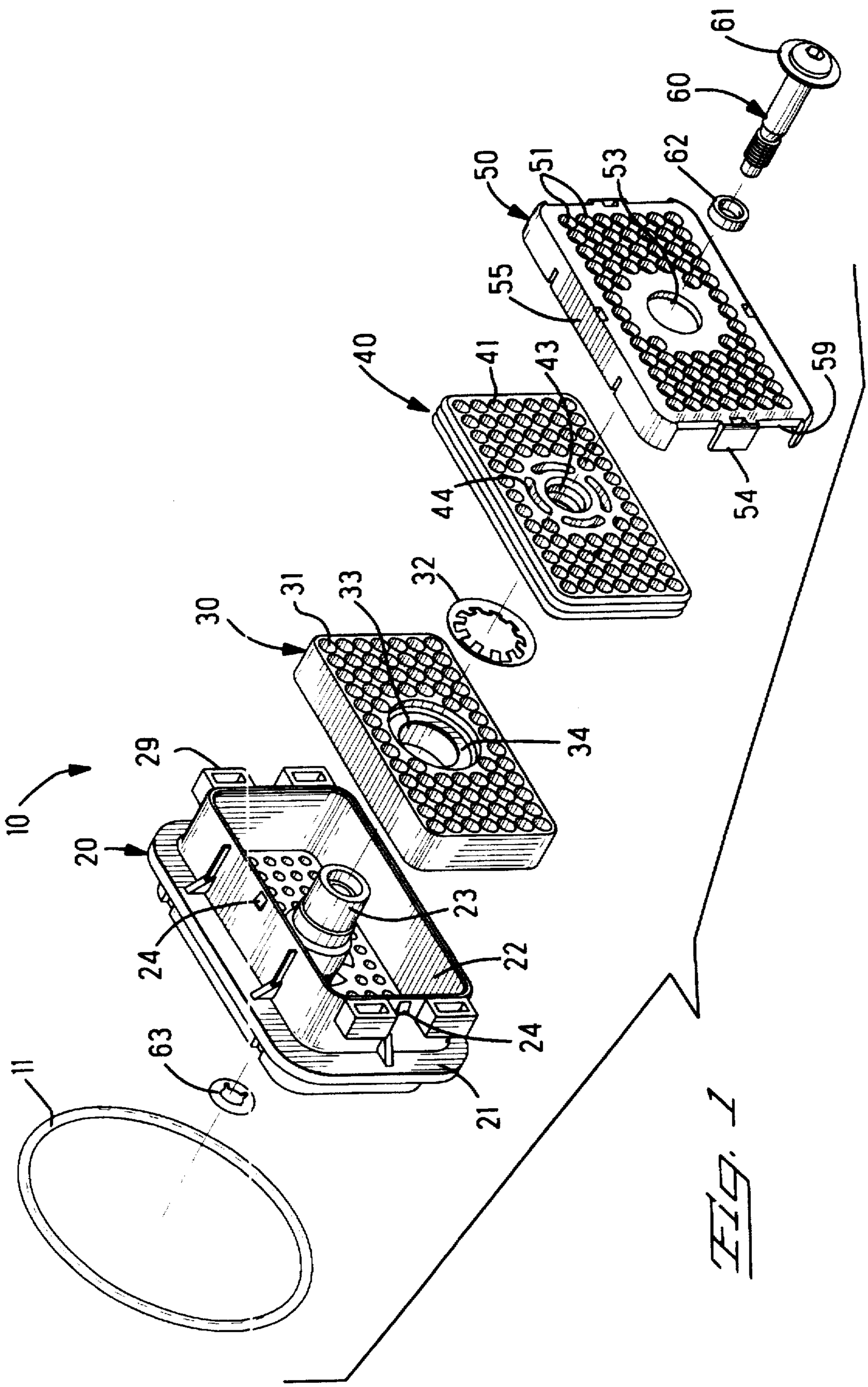

61
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Fig. 7

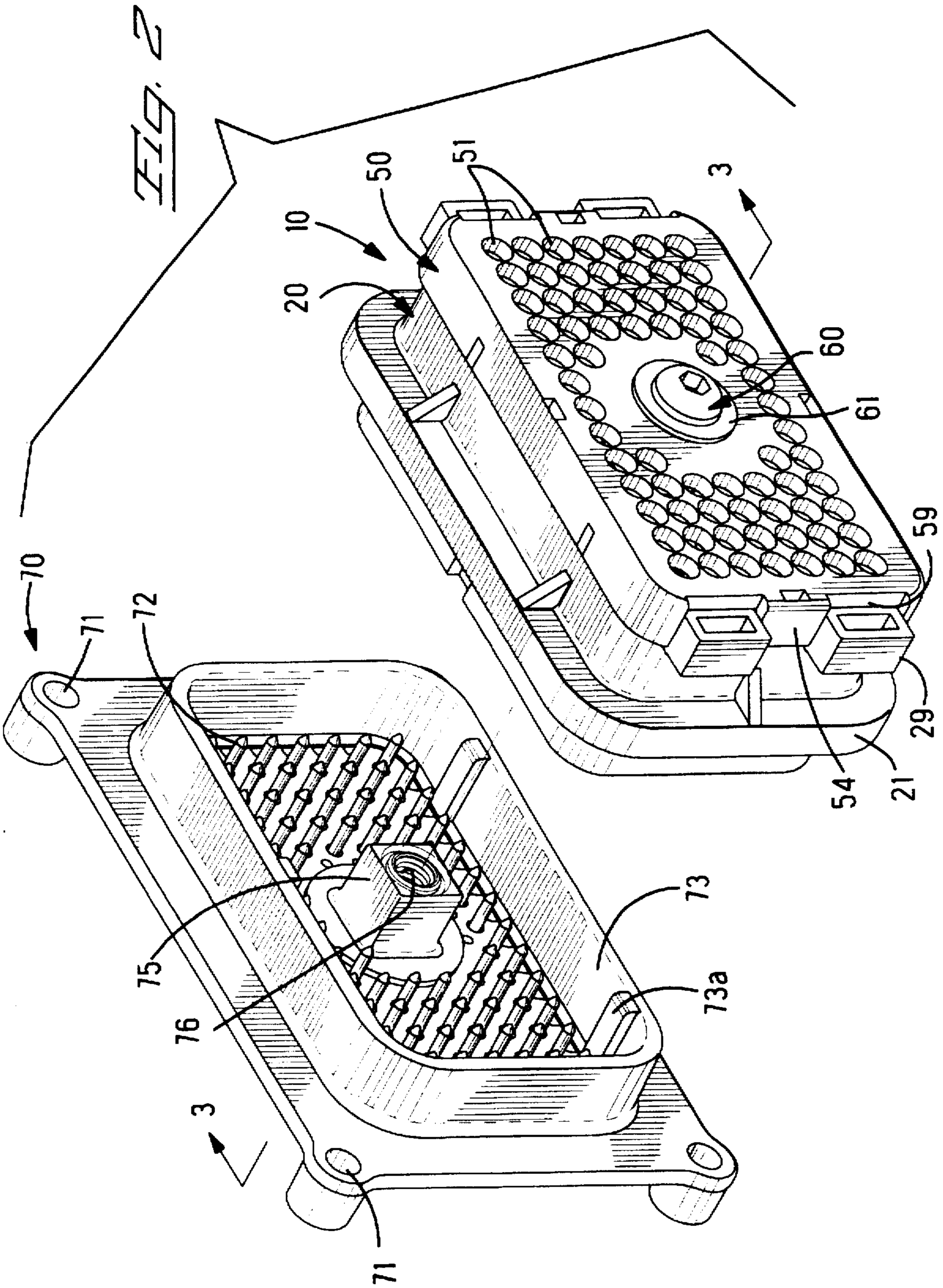
FIG. 2
10
20
50
51
3
60
61
59
29
54
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70
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72
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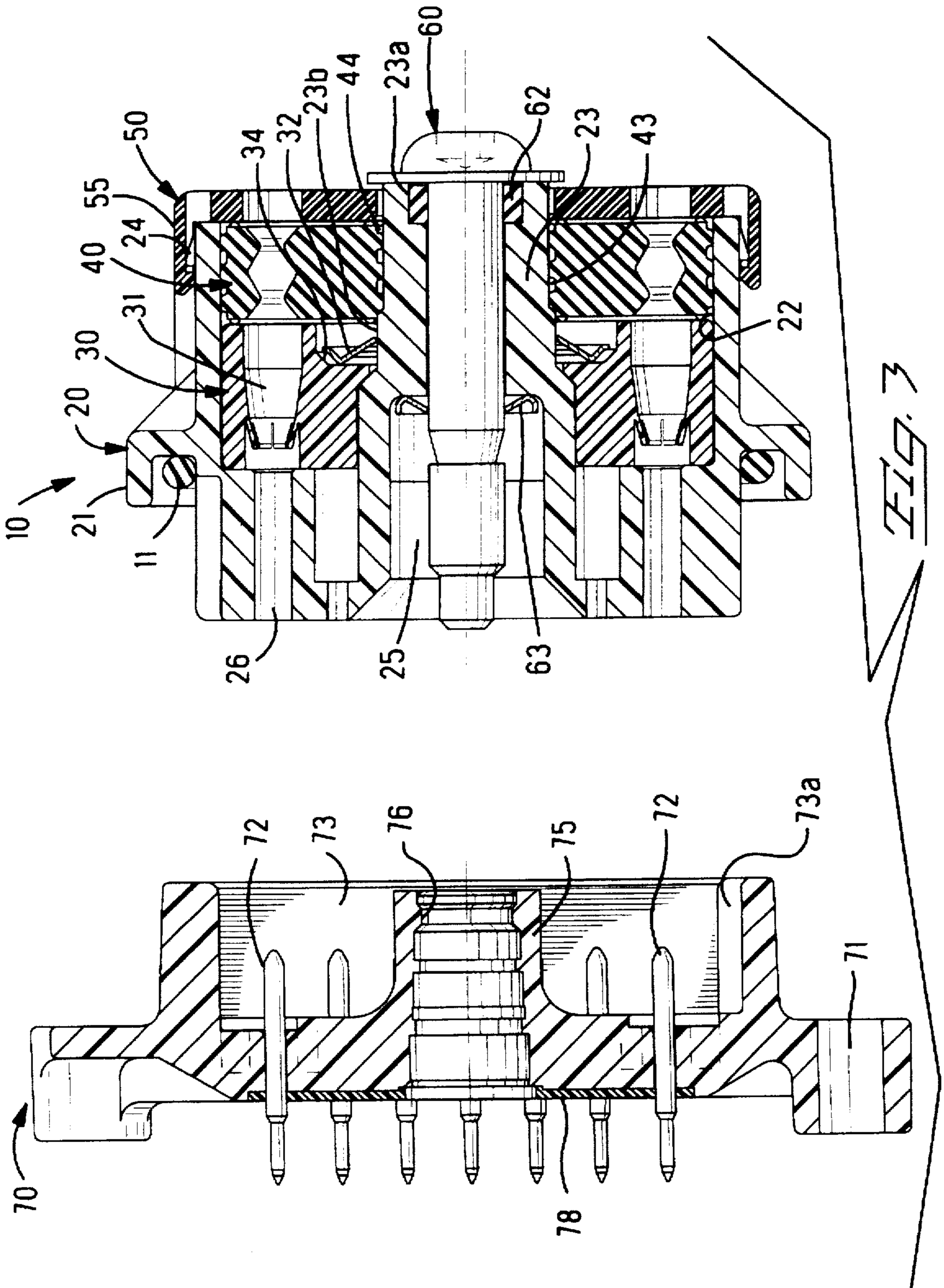
76
73
73a
3
71


50
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23b
44
23a
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75
12
73a
71
70
78

Fig. 3

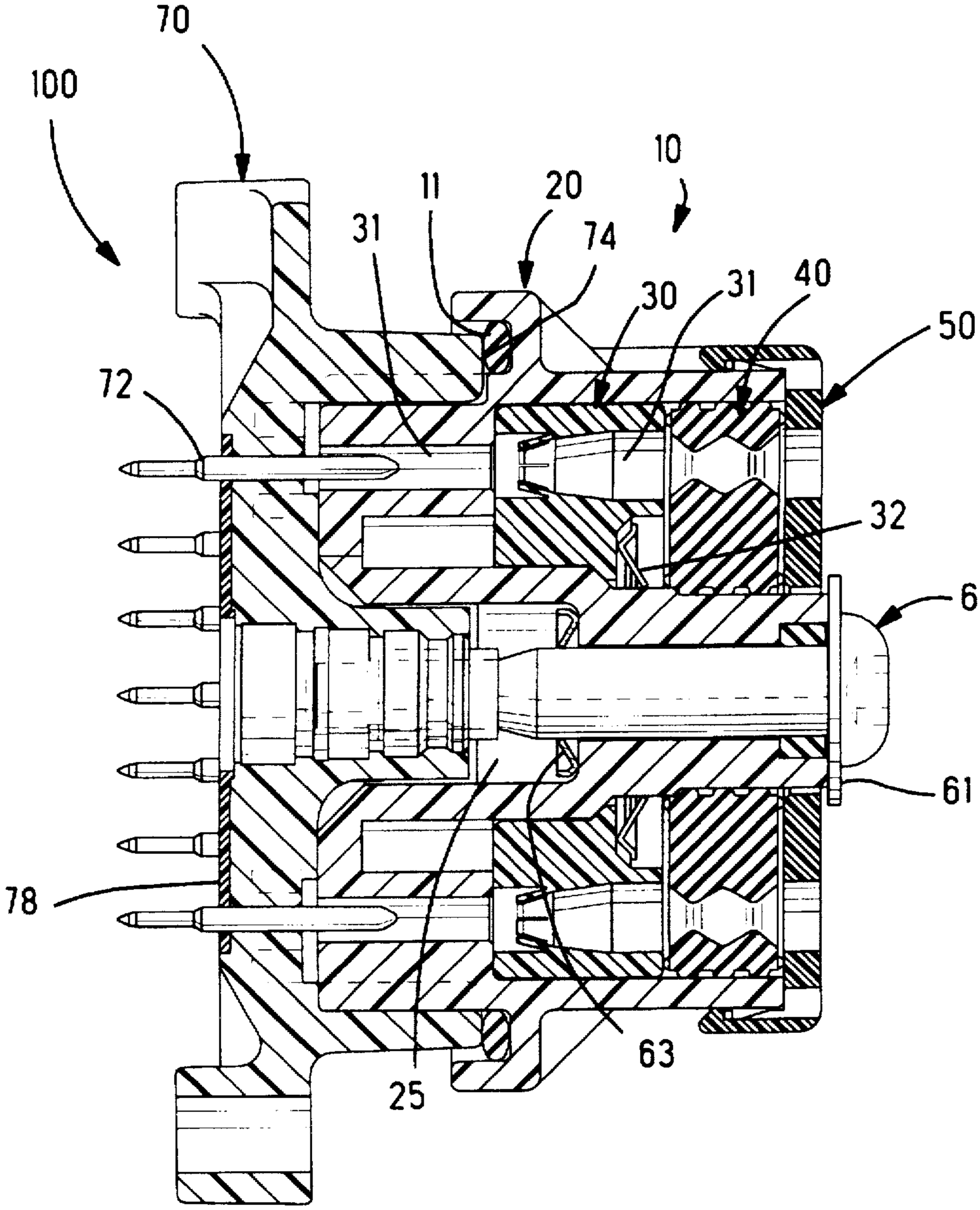

Fig. 4

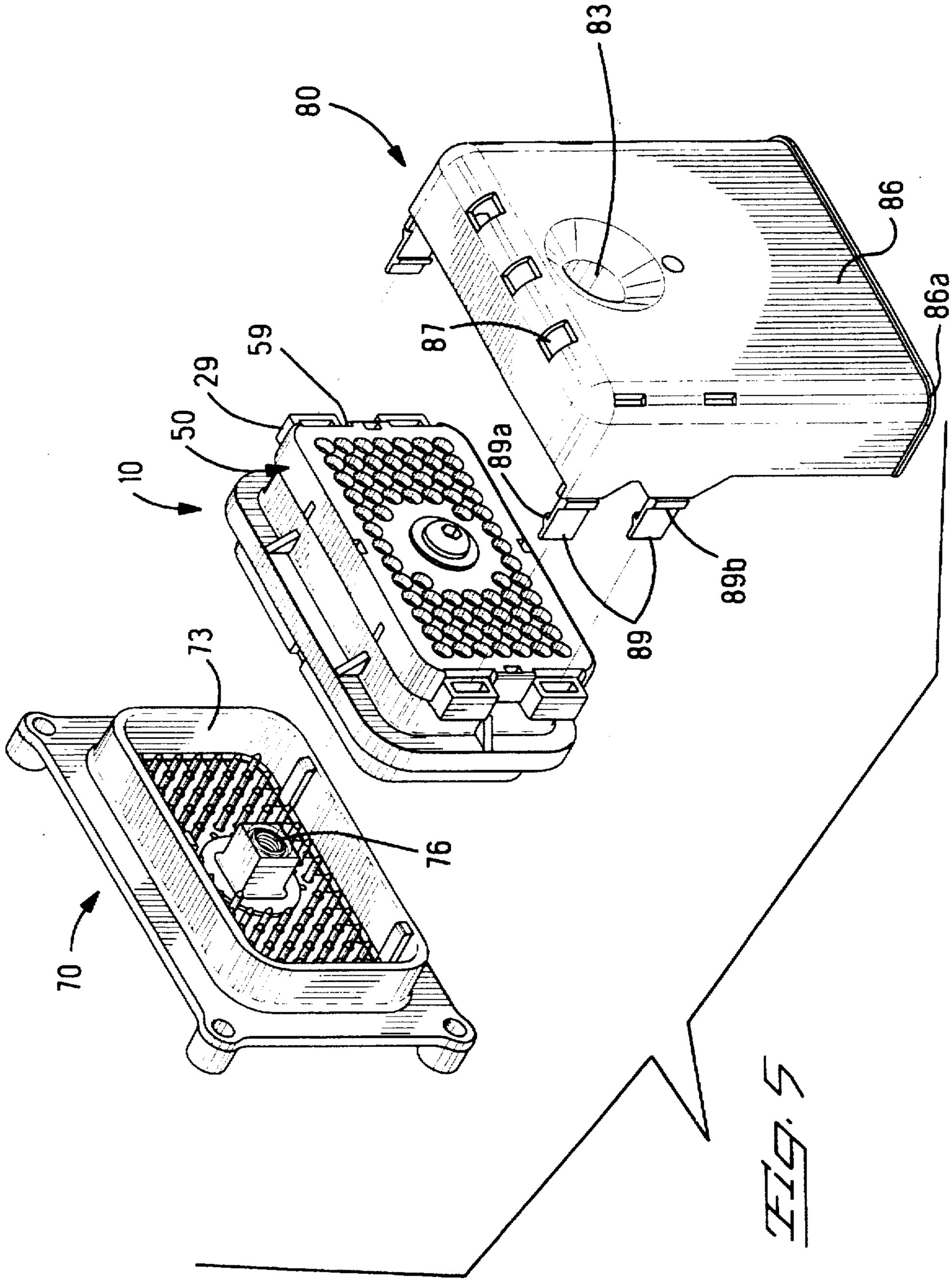

Fig. 5

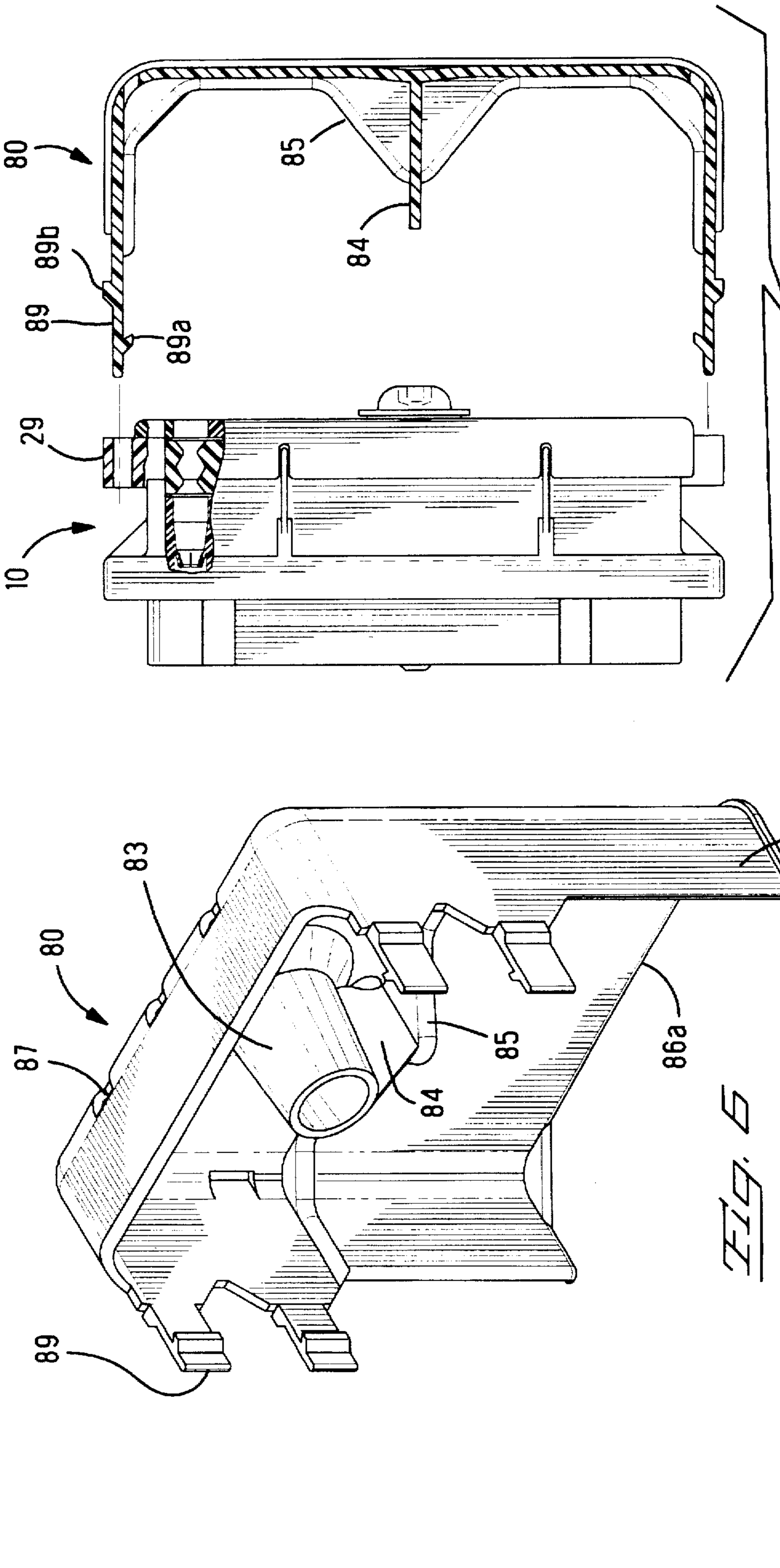

Fig. 7

Fig. 8

SEALED ELECTRICAL CONNECTOR WITH JACK SCREW

The present invention relates to an electrical connector assembly comprising a jack screw for joining matable connector halves of the assembly; more particularly, one of the mating halves comprises a sealed connector subassembly with the jack screw rotatably mounted therein, and a contact retention insert assembled to the housing with an insert retaining clip.

BACKGROUND OF THE INVENTION

Sealed electrical connectors are commonly used in the automotive industry to preserve the electrical connections therein from degradation due to moisture or other contaminants. Individual wire seals are conventionally used for sealing connectors; however, such wire seals are disadvantageous because they are expensive to produce and assemble to respective wires. Alternatively, blanket type wire seals are used to lower the cost of producing sealed electrical connectors. Moreover, jack screws are used with sealed connectors to provide the requisite contact mating forces for mating the connector halves together.

A known electrical connector having a jack screw mating mechanism, and subassemblies with individual wire seals, is disclosed in U.S. Pat. No. 5,201,625 which is hereby incorporated by reference in its entirety. Assembly of the connector requires that individual wire seals are preassembled to respective wires, and then the sealed wire is inserted into a connector housing for electrical interconnection with a matable electrical contact. The housing configuration requires a guillotine type connector latch mechanism for contact retention. This conventional assembly is expensive to produce because it requires many parts and assembly steps in order to make each sealed connection, and is expensive to manufacture because of the guillotine type contact retention feature and assembly steps appurtenant thereto.

In light of the above problems, what is needed is an electrical connector that advantageously: combines the advantages inherent in a blanket type seal with a jack screw connector mating mechanism; securely retains electrical contacts; provides mechanical and electrical reliability of the electrical interconnections in the connector; is inexpensive to produce; and uses a minimum number of parts which can be quickly assembled with quality and reliability assured in the final product.

SUMMARY OF THE INVENTION

The foregoing advantages are achieved by the present invention which essentially comprises an electrical connector subassembly having: (a) a housing for receiving a contact retention insert, and the housing includes a tower section; (b) a contact retention insert, the retention insert comprises at least one electrical contact receiving cavity therein, and the retention insert comprises an aperture, the tower extends through the aperture; and (c) a retaining part is mounted adjacent to the contact retention insert, and a section of the retaining part bites into a portion of the tower for retaining the contact retention insert with the housing.

The retaining part comprises an annular ring formed of a spring grade metallic material, and the retaining part comprises detents for biting into the tower. The contact retention insert comprises a recess which receives the retaining part therein, and the recess includes a bearing surface for supporting the retaining part therein.

The tower comprises a fastener retaining member in a recess thereof, and the fastener retaining member is disposed radially inwardly relative to the retaining part. Additionally, the tower comprises a fastener sealing member in a recess thereof wherein the fastener sealing member is disposed radially inwardly relative to the retaining part.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows an exploded isometric view of a connector subassembly according to the present invention.

FIG. **2** shows the subassembly of FIG. **1** in a fully assembled state arranged to be connected to a matable connector comprising a contact pin array.

FIG. **3** shows a cross sectional view of the subassembly and header of FIG. **2** taken along line **3—3**.

FIG. **4** shows a cross sectional view of the subassembly and header of FIG. **3** in a fully assembled state.

FIG. **5** shows an exploded isometric view of the subassembly and header of FIG. **2** with a wire guide member according to the present invention.

FIG. **6** shows an isometric view of the wire guide member of FIG. **5**.

FIG. **7** shows a cross sectional view of the wire guide member of FIG. **6** arranged to be connected to the subassembly of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, the sealed connector subassembly **10** of the present invention will be described. Sealed connector subassembly **10** comprises an interface seal **11**, a plug housing **20**, a contact retention insert **30**, a wire seal **40**, a seal cover **50**, and a jack screw **60**.

Referring to FIGS. **1–3**, plug housing **20** includes: a seal receiving section **21** for receiving interface seal **11**; a contact retention insert receiving cavity **22**; a bolt tower **23** having a seal recess **23***a* for receiving bolt seal **62** therein; a friction surface **23***b* for frictionally receiving insert retaining clip **32** thereon; detents **24** on an outer surface thereof for receiving latches formed on the seal cover **50**; a mating recess **25** for receiving a portion of header **70** (see FIG. **4**); and pin receiving apertures **26** for receiving pins **72** of header **70** (see FIG. **4**). Additionally, a plurality of wire guide mounts **29** are formed on an outer surface of plug housing **20** for receiving latching legs **89** of wire guide **80** (see FIG. **7**).

Now referring to FIGS. **1**, **3**, and **4**, contact retention insert **30** will be described. Contact retention insert **30** includes: contact receiving apertures **31** having latching fingers for latchable engagement with respective electrical contacts to be inserted therein; an insert retaining clip **32** having detents for biting into frictional surface **23***b* of bolt tower **23**, and which clip advantageously retains the insert **30** within the cavity **22** of plug housing **20**; a bolt tower receiving aperture **33** for receiving bolt tower **23** therethrough; and an insert clip flange **34** for pressing engagement with the insert retaining clip **32**.

Again referring to FIGS. **1**, **3**, and **4**, wire seal **40** will be described. Seal **40** includes: contact receiving apertures **41**; a bolt tower receiving aperture **43** having undulated surfaces for sealingly receiving bolt tower **23** therethrough; and sealing void spaces **44** allowing the seal to accommodate the bolt tower **23**. Contact receiving apertures **41** include undulated surfaces for sealing engagement with conductors terminated to electrical contacts to be inserted in insert **30**.

Referring to FIGS. **1–3**, seal cover **50** is latchably mounted to housing **20**. Seal cover **50** includes: contact

receiving apertures **51**; a bolt tower receiving aperture **53** for receiving bolt tower **23** therethrough; and side latches **54** and top latches **55** for latchably engaging latching detents **24** of plug housing **20** thereby retaining seal **40** within housing **20**. Wire guide recesses **59** are provided for receipt of latching wire guide mounts **29** of housing **20**, as is shown best in FIG. **5**.

FIGS. **1**, **3**, and **4** best show the details of jack screw **60**. Jack screw **60**, as installed in assembly **10**, cooperates with: a washer **61**; a seal **62**; and a retaining clip **63** for rotatably retaining jackscrew **60** in the plug housing **20**. The jack screw **60** is rotatably mounted on the plug housing **20** but is axially locked in place between washer **61** and retaining clip **63**. Retaining clip **63** allows rotational movement of the jack screw **60** relative to plug housing **20**, but resists any axial displacement of the jackscrew **60** relative to plug housing **20**.

Referring now to FIGS. **2–5**, header housing **70** will be described. Header housing **70** includes: a plurality of mounting holes **71** for receiving fasteners for the purpose of mounting housing **70** to a component surface (not shown in the drawings); pin array **72** for electrical connection to contacts to be inserted in subassembly **10**; and a cavity **73** for matably receiving the subassembly **10** therein. Additionally, polarizing ribs **73***a* are formed in cavity **73** for requiring proper polarization of subassembly **10** relative to the pin array **72**. Header housing **70** further includes: a sealing face **74**, as best shown in FIG. **4**, for sealing engagement with interface seal **11**; and a tower **75** including a threaded insert **76** for threadable engagement with jack screw **60**. FIG. **4** also shows a silicone-base, UV light cured sealant material **78** layered around the pin array **72** for providing a seal interface on the component side of header **70**.

Referring to FIGS. **5–7**, a wire guide **80** according to the present invention will be described. Wire guide **80** includes a bolt access tower **83** for a tool to have access to jack screw **60**; and, as shown in FIGS. **6–7**, wire guide **80** includes an intermediate reinforcement member **84** disposed between the tower **83** and a transverse reinforcement member **85**. The reinforcement members serve the purpose of stiffening the wire guide **80**, which stiffening is advantageous because the wire guide must pressingly guide a plurality of wires exiting from the subassembly **10** in order to minimize the space taken up by the wires in, for example, an engine compartment. Reinforcement members **84**, **85** thus prevent buckling of the wire guide due to the pressing and guiding of the wires. Additionally, wire guide **80** comprises a lower section **86** thereby defining an extension of wire guide **80** for: protecting wires extending toward, for example, a braid of a wiring harness; preserving wire identification; and avoiding abrasion of wires exiting subassembly **10** by virtue of an edge radius profile **86***a*. Through holes **87** are provided for drainage of moisture or other contaminants from the wiring harness.

Referring to FIG. **7**, latching legs **89** include front lugs **89***a* and back lugs **89***b* for latching engagement with wire guide mounts **29** of plug housing **20**. Installation of wire dress **80** requires that respective lugs **89***a* will be inserted through respective guide mounts **29** so that respective lugs **89***b* will make an interference fit with guide mounts **29**. Removal of cover **80** from subassembly **10** requires deflection of lugs **89***a* away from subassembly **10** so that lugs **89***a* are positioned to be retracted through guide mounts **29**, and then cover **80** is pulled away from subassembly **10**.

FIG. **4** shows the overall mated assembly **100** without the wire guide **80**. However, in a preferred embodiment with wire guide **80** installed on assembly **100**, the wires will exit from the assembly **10** and will be generally oriented at a 90 degree angle relative to a mating axis of the subassembly **10**.

Additionally, in the preferred embodiment of assembly **100**, the contact retention insert **30** is inserted in cavity **22** of plug housing **20** and the insert retaining clip is pressed against the insert clip flange **34** so that the frictional detent members of insert retaining clip **32** will bite into the friction surface **23***b* of plug housing **20** thereby retaining the insert in the plug housing **20**. It is notable, however, that friction surface **23***b* includes an outer diameter which is larger than the outer diameter of the bolt tower **23** adjacent to seal recess **23***a*, which facilitates installation of clip **32** as the inner diameter of the clip is sized to bite into only the larger diameter of surface **23***b*. Next, blanket-type wire seal **40** is inserted into cavity **22**, and seal cover **50** is placed over the wire seal **40** so that latches **54**, **55** engage cover detents **24**, cover **50** thereby retains the seal **40** in cavity **22**.

Referring now to FIG. **4**, an electrical contact (not shown) can be inserted into contact receiving aperture **31** so that the resilient fingers of aperture **31** will frictionally engage the electrical contact, and the pin array **72** will be aligned for electrical engagement with the contact. The operator then need only rotate jack screw **60** so that the header **70** will be drawn into mating engagement with subassembly **10**. During this assembly step, electrical contacts in apertures **31** of subassembly **10** will be brought into electrical engagement with respective pins of contact pin array **72**. With wires grouped accordingly, wire guide **80** will be aligned with the mated assembly **100**, latching legs **89** of wire guide **80** will be inserted in wire guide mounts **29**, and wire guide **80** will be pressed towards the mated assembly **100** thereby dressing the wires in a generally 90 degree angle relative to the mating axis of the mated assembly **100**. As shown in FIG. **5**, bolt access tower **83** of wire guide **80** will be aligned with jack screw **60** so that the operator may later have access for a tool to remove subassembly **10** from the header housing **70**. An advantage of bolt access tower **83** is that jack screw **60**, and bolt tower **23**, need not be excessively long for tool access purposes, i.e. reach to the outer surface of the wire guide **80**, because bolt access tower allows the tool to extend to the seal cover.

The foregoing invention: combines the advantages inherent in a blanket type seal **40** with a jack screw connector mating mechanism **60**; securely retains electrical contacts in a contact retention insert **30**; provides mechanical and electrical reliability of the electrical interconnections in the connector; and, by virtue of the retaining clip **32**, is inexpensive to produce, and uses a minimum number of parts which can be quickly assembled with quality and reliability assured in the final assembly **100**.

Thus, while a preferred embodiment of the invention has been disclosed, it is to be understood that the invention is not to be strictly limited to such embodiment, but may be otherwise variously embodied and practiced within the scope of the appended claims.

Accordingly, what is claimed is:

1. An electrical connector subassembly comprising:

(a) a housing with a housing cavity for receiving a contact retention insert therein, and a tower section;

(b) a contact retention insert disposed in said housing cavity, said retention insert comprises at least one electrical contact receiving cavity therein, and said retention insert comprises an aperture, said tower extends through said aperture; and

(c) a retaining part is mounted in said housing cavity for contact with said contact retention insert, and a section

of said retaining part engages a portion of said tower for retaining said insert in said housing cavity.

2. The subassembly of claim **1**, wherein said retaining part comprises an annular ring.

3. The subassembly of claim **1**, wherein said retaining part comprises detents for said engagement.

4. The subassembly of claim **1**, wherein said tower is integral with said housing.

5. The subassembly of claim **1**, wherein said contact retention insert comprises a recess which receives said retaining part therein.

6. The subassembly of claim **5**, wherein said recess includes a bearing surface for supporting said retaining part.

7. The subassembly of claim **1**, wherein said tower comprises a fastener retaining member in a recess thereof.

8. The subassembly of claim **7**, wherein said fastener retaining member is disposed radially inwardly relative to said retaining part about said tower.

9. The subassembly of claim **1**, wherein said tower comprises a fastener sealing member in a recess thereof.

10. The subassembly of claim **9**, wherein said fastener sealing member is disposed radially inwardly relative to said retaining part about said tower.

11. An electrical connector subassembly comprising:

(a) a housing for receiving a contact retention insert, and said housing includes a tower section;

(b) a contact retention insert, said retention insert comprises at least one electrical contact receiving cavity therein, and said retention insert comprises an aperture, said tower extends through said aperture; and

(c) a retaining part is mounted adjacent to said contact retention insert, and a section of said retaining part engages a portion of said tower for retaining said contact retention insert with said housing.

12. The subassembly of claim **11**, wherein said retaining part comprises an annular ring.

13. The subassembly of claim **11**, wherein said retaining part comprises detents for said engagement.

14. The subassembly of claim **11**, wherein said tower is integral with said housing.

15. The subassembly of claim **11**, wherein said contact retention insert comprises a recess which receives said retaining part therein.

16. The subassembly of claim **15**, wherein said recess includes a bearing surface for supporting said retaining part.

17. The subassembly of claim **11**, wherein said tower comprises a fastener retaining member in a recess thereof.

18. The subassembly of claim **17**, wherein said fastener retaining member is disposed radially inwardly relative to said retaining part.

19. The subassembly of claim **11**, wherein said tower comprises a fastener sealing member in a recess thereof.

20. The subassembly of claim **19**, wherein said fastener sealing member is disposed radially inwardly relative to said retaining part.

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